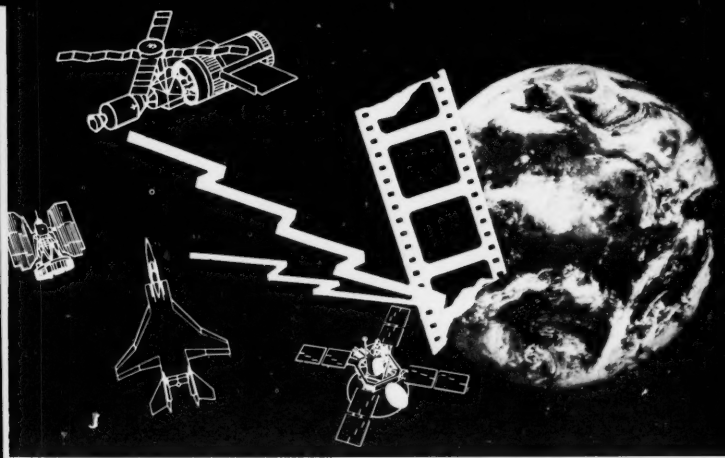

NASA ACTIVITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

October 15, 1974 Vol. 5, No. 10

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LETTER FROM WASHINGTON

October 4, 1974

Dear Colleagues:

In last month's letter I wrote about the planning study called "Outlook for Space" underway within NASA. Now I would like to tell you about a sister study called "Outlook for Aeronautics" and invite you to contribute the ideas and comments we need to make it a valuable tool for the years ahead.

The purpose of this study is to assess the challenges that will come, and the opportunities we can create, in the field of aeronautical development in the period 1980-2000, to the extent we can foresee them now. The study will seek to identify the probable and possible future directions of civil and military aviation, the technological advances that will permit such future directions to be followed, and the role that NASA should play in aeronautical development in this period.

I have emphasized that I want this study not only to be comprehensive and imaginative, but also that it examine the relationship of aeronautics to national goals and objectives. We want to produce a study that will assist NASA in presenting the best possible aeronautics programs relevant to national needs, for the remainder of this century, to the Administration, the Congress, and the people.

NASA and its predecessor, NACA, have contributed a major share of the aeronautical research foundation upon which our nation's military and civil aviation pre-eminence has been built. A major

COVER

White House visit of Soviet Cosmonauts Kubasov and Leonov, standing at the table on the President's right, with Ambassador Dobrynin in the immediate rear. See story on Page 8.

responsibility of NASA today is helping maintain U.S. world leadership in aviation—a position now being threatened by increasingly serious foreign competition.

Many of you are no doubt acquainted with the importance of the aeronautical products market, both civil and military. Because of our technological leadership, America has produced and sold more than $235 billion worth of aviation products—not including space products—over the last 25 years. A significant percentage of these sales was to overseas buyers. Eight out of 10 civil air transports flying for Free World airlines are American-designed and built. A major share of the general aviation market, domestic and foreign, is American also. And our military air defense is second to none.

This predominance in aeronautical technology has been such as to maintain a favorable balance of trade for the nation which might otherwise have been in the red. In addition, hundreds of thousands of jobs have been created by this vital technological pre-eminence. To lose it would mean U.S. dependence on foreign aircraft industry sources for both our civil air transport requirements and for our military aircraft. This would place an intolerable burden on the economy and America's air defense capabilities.

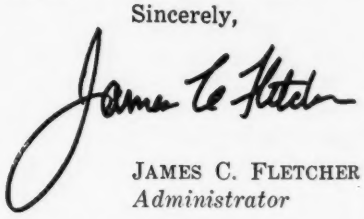
In preparing this new long-range planning study, we have the great responsibility of indicating how America's pre-eminent position in aeronautics can be maintained and enhanced. The stakes are too high for any other approach.

The "Outlook for Aeronautics" study group, under the chairmanship of Dr. Leonard Roberts, Director, Aeronautics and Flight Systems, Ames Research Center, will be meeting with government agencies to get their inputs, which are essential.

This aeronautics study, like the space study already underway, is not something being worked up for publicity purposes; it is intended primarily for in-house guidance in making sound future decisions on the directions our aeronautical programs should take. We do need the enthusiastic support of everyone within NASA who can relate to the study group members in any way to make this an outstanding planning effort and a productive guide to the future of aeronautics.

Details about the study and names of the study group members are given elsewhere in this issue of NASA ACTIVITIES. If we can produce an outstanding study, it will have a significant beneficial impact on the future of NASA, and, indeed, on the future of our country. We need your help.

Sincerely,



JAMES C. FLETCHER
Administrator

MONTHLY NASA HIGHLIGHTS

LANGLEY TECHNOLOGY REVIEW

A special review of "Technology in the Service of Man" was held at the Langley Research Center during the week of Sept. 10. The review covered work undertaken at NASA Centers in aeronautics and space technology, energy resources, and environmental protection. Special presentations highlighted technology for safer aircraft; energy efficient flight; low-speed aircraft; supersonic and hypersonic aircraft; quieter airport communities; preservation of Earth's atmosphere; protection of the marine environment; exploration of the planetary environment; and energy sources and utilization. The review was well received by members of Congress, aeronautics and aerospace industry leaders, academicians, and representatives of federal, state and local agencies who attended.

(Editor's Note: A more detailed account of the review, with illustrations, will be included in the November issue of NASA ACTIVITIES.)

NEW WING FOR LIGHT AIRCRAFT

Industry is enthusiastic about a new general aviation wing developed at the Langley Research Center and presently being tested there. The wing design is based on a new airfoil identified as the GAW–1, a derivative of the supercritical airfoil, also developed at Langley. In wind tunnel tests, this new airfoil demonstrated the potential for up to a 30 per cent increase in maximum lift over airfoils currently found in general aviation airplanes. Lift-to-drag ratio was increased by about 50 per cent. The wind tunnel results were verified recently by flight testing of a Piper Seneca aircraft, modified to include the new wing design. In addition to the low-speed airfoil, the new wing design has a 25 per cent reduction in area, tapered planform, full-span Fowler flaps, and spoilers for roll control instead of conventional ailerons.

AIR TRAFFIC CONTROL SAFETY TESTS CONDUCTED

Vortices generated at the wing tips of large aircraft trail behind for several kilometers and present a hazard to other aircraft, especially small ones which may be following too close in the wake. Aircraft must be spaced far apart to avoid wake interaction effects during takeoff and landing, a situation which contributes significantly to air traffic congestion at airports. NASA is exploring techniques which may alleviate this congestion by making it possible to reduce the spacing between aircraft. Methods either to suppress initial formation of high intensity vortices or to promote their early dissipation once they are formed are being investigated. From late August through early September, Flight Research Center conducted inflight tests of changes in span-load distribution and engine-induced turbulence, using a Boeing 747. A Lear Jet and a T–37 aircraft following the larger airplane were used to probe and record the effects of the reduced or altered vortices on smaller planes at takeoff and landing. Research teams are examining ways to minimize any penalties the new techniques may introduce into efficient airport operations. In addition to the work at FRC, the problem of trailing vortices is being studied in flight tests at Wallops Flight Center and in ground-based research at Langley and Lewis Research Centers.

LANGLEY RESEARCH ADVANCES WING DRAG REDUCTION

Dr. Richard T. Whitcomb, Head of the Eight-Foot Tunnels Branch of the High-Speed Aircraft Division at Langley Research Center and one of the nation's most distinguished aeronautical engineers, recently outlined to NASA top management strides being made by the Langley Research Center in reducing airplane wing drag through the use of vortex diffusers. These vortex diffusers, which have attracted the interest of the aircraft industry, are small wing-like devices added vertically to the rearward parts of the tips of the wing of an airplane to reduce the drag due to lift. The devices are designed exactly like a wing with a high aspect ratio, taper, and camber. The two additions have a total area of about 2.5% of the wing area with spans of about 6% of the wing span. The vortex diffuser reduces the inflow above the wing and produces two vortices behind the wing which are significantly weaker than the single vortex produced without the device. This effect reduces the drag associated with vortex by about 15%. This results in an improvement in the aerodynamic efficiency of the total aircraft of about 5% with a corresponding improvement of fuel consumption. These vortex diffusers might be added to existing aircraft or at least to new production aircraft.

NASA TECHNOLOGY REDUCES JET NOISE POLLUTION

A four-engine United Air Lines DC–8 jet transport in regular airline service, using a newly developed, NASA two-segment landing approach, is achieving a 53 per cent reduction in the ground area impacted by noise above desirable tolerances in a normal landing approach. This is the second in-flight evaluation of modified landing procedures conducted by United Air Lines for the Ames Research Center. Last year, a United 727 aircraft, equipped with a special-purpose avionics package developed by Collins Radio Company under separate NASA contracts, made 555 two-segment approaches in regular airlines service. The program is part of a joint NASA/Federal Aviation Agency study to reduce jet-engine noise over airport communities. Boeing and McDonnell-Douglas, also under contract to Ames, have been studying the feasibility of applying the new technique to their commercial transports. A similar study is being conducted by Lockheed on its L–1011 airplane.

TURBINE ENGINE LIFE EXTENDED BY NASA SHAFT SEAL

Lewis Research Center is perfecting a NASA-developed mainshaft seal for turbine engines which is capable of reducing wear, maintenance, and fuel consumption. The lift-pad seal, as it is known, operates under severe conditions where conventional rubbing contact seals would fail. Less maintenance and fewer replacement parts should be required since the minimized passage of dust permitted by the lift-pad seal decreases wear of rotating parts. Application of the new seal could reduce oil loss and save an estimated $1.5 million yearly in lubricant costs for the country's 747 fleet. Other potential uses include industrial gas line compressors where the new seals would substantially decrease pollution of the atmosphere by oil mist and would reduce the complexity of current lubricating systems. A lift-pad seal is also being developed to solve a critical seal need in the Space Shuttle LOX (liquid oxygen) pump where seals of the conventional types are characterized by inadequate life and high leakage rates.

FIRST NETHERLANDS SATELLITE LAUNCHED

The Netherlands Astronomical Sattelite (ANS-A), the first Netherlands/United States Cooperative Satellite, was launched on August 30 by a four-stage Scout vehicle from Vandenberg Air Force Base, California. A guidance malfunction caused the ANS-A to be placed in orbit with an apogee of 1174 kilometers, perigee of 268 km, inclination of 84 degrees and a period of 99 minutes (the planned orbital parameters were apogee 560 km, perigee 510 km, inclination 97.8 degrees, and period 95 minutes). The different orbit will require a modified science observation program, but there will be no significant impact on the experiment or spacecraft performance or mission operations. The principal effect on the scientific program is the loss of observing time with the two X-ray experiments. The higher apogee causes a longer passage through the Van Allen belts during which the X-ray experiments do not function. Operations with the UV telescope have indicated no apparent constraints either on the observing program or detector performance. The orbit provides about nine months of full sunlight rather than the six months previously expected, permitting reobservation of objects planned for the first three months' observation program. Although the scientific observation program could be somewhat hindered, the ANS mission objective to increase the scientific knowledge of stellar ultraviolet and X-ray sources will be achieved.

MARS CAMERA TESTS EXCEED EXPECTATIONS

The Viking Lander Imaging Science Team has completed the first tests of the camera which will photograph Mars from ground level when Viking spacecraft land on Mars in 1976. The team consists of 15 scientists, engineers, and technicians under the leadership of Dr. Thomas A. Mutch, Brown University professor of Geology. Results of the first test photographs, which were taken near Denver, CO, and at the Great Sand Dunes National Monument in southwest Colorado, have been termed "successful beyond expectations." The camera's performance and versatility were unmatched by any that NASA has yet flown on an unmanned mission. The reproductions were extremely accurate, with sharp resolution and excellent detail of the remarkable views photographed. The Lander's imaging system consists of two cameras, weighing only 16 pounds each, rising like twin periscopes from the top of the three-legged Lander. The Viking cameras will scan from the nearest Lander footpad to an angle of 40 degrees above the horizon and rotate 340 degrees for panoramic coverage of the Martian surface. They will provide color, black-and-white, infrared and stereoscopic views.

COSMONAUTS TRAIN AT HOUSTON

After a weekend in Washington, DC, highlighted by their attendance at a community crab feast along with President Ford, the Soviet Apollo-Soyuz Test Project crew commenced three weeks of training with their U.S. counterparts at Johnson Space Center on Sept. 8. The joint training program included flight simulations, procedures, training in Apollo and docking module mockups, training in communications, and study of spacecraft systems. The crews will not train together again until spring of next year when sessions will be conducted in both countries.

FIRST ATS–6 SHIP-TO-SHORE TRANSMISSION SUCCESSFUL

The world's first L-Band transmission from ship to shore via the ATS–6 Communications Satellite was accomplished on August 20. Both voice and teletype links were established via the satellite between Kings Point, New York, and the ship *AMERICAN ACE* in the Atlantic Ocean. Transmissions were of excellent quality. Future operational systems of this type for both maritime and aeronautical application could save millions of dollars by speeding up day-to-day operations. Specific potential benefits to maritime operations include transmittal of cargo manifests and documentation prior to ship arrival in port, transmittal of payroll data for shore processing, and the remote monitoring and transmittal of ship machinery performance. Other active participants in the L-Band experiment included the U.S. Coast Guard and the Federal Aviatiom Agency, as well as Canada's Department of Communications and Ministry of Transport, and the European Space Research Organization.

GOVERNMENT AND INDUSTRY MEET ON BROADCAST SATELLITE TECHNOLOGY

Eighteen industrial concerns were represented at a government-industry meeting on broadcast satellite technology held at the Goddard Space Flight Center on August 28. The Department of Health, Education and Welfare presented brief-

ings on the Health and Education Telecommunication Experiment on ATS–6, the potential market for future broadcast services, and their interest in seeing service provided to support educational and health-care needs. HEW outlined plans for future meetings with user groups to help develop markets for broadcast services. NASA briefed the conferees on existing technologies for broadcasting satellite systems. Both NASA and HEW offered to meet again with interested industry groups to further facilitate the transfer of technology.

SATELLITE ADVANCES WEATHER REPORTING

The Synchronous Meteorological Satellite–1 (SMS–1), launched from Kennedy Space Center on May 17 of this year, has been contributing notably to improved weather reports. NASA, in a 30–day experiment with the major U.S. television broadcasting companies, has provided the networks with daily tape-recorded, time-lapse cloud pictures. The weather pictures, showing the weather in motion for a 72–hour period, were given to the television networks which then transmitted the pictures to affiliated stations in time for the evening news reports. The series of pictures on the tapes, for example, made it possible for the public to trace the movement of a hurricane across the Atlantic Ocean during a 72–hour period and show where it was on the day the tapes were distributed. SMS–1 also had a major role in tracking Hurricane Carmen. Storm refugees were housed at NASA's National Space Technology Laboratories near Bay St. Louis, MS. The satellite permitted, for the first time, a 24–hour day and night watch of the storm by the National Oceanic and Atmospheric Administration's (NOAA) National Hurricane Center in Miami, FL. Dr. Neil L. Frank, the Center's Director, considers that "satellites are the cornerstone of the hurricane warning service" and that "there is no way a major hurricane or severe storm can strike the United States undetected."

ERTS AIDS WATER RESOURCES MANAGEMENT

The Earth Resources Technology Satellite (ERTS–1) is becoming of increasing value to hydrologists who are applying data returned from the spacecraft to enhance water resources management. Satellite observations of surface water and snow accumulation and, possibly, even the location of subsurface water supplies will continue to make future planning more accurate, economical, and coordinated. Data are being used by federal and state agencies for flood control, irrigation, and soil moisture identification; ground water level measurements; lake and dam counts; identification of current circulation patterns; pollution and sedimentation in estuaries and lakes; ice and snow coverage; even glacier and iceberg monitoring. Images of surface characteristics are used, as well as information from more than 100 Data Collection Platforms now operating from Iceland to Hawaii and Northern Canada to Central America collecting surface data and transmitting it to orbiting satellites for retransmission to water resources management agencies.

CONGRESSIONAL "BELT TIGHTENING"

The President on Sept. 6 signed the bill (P.L. 93–414) making appropriations in the amount of $3,206,735,000 to NASA for the fiscal year ending June 30, 1975. The amount provided is $35,959,000 below the budget request and $60,194,000 below the amount authorized in Public Law 93–316, the NASA Authorization Act. Research and Development funding was reduced by $15 million without specific deletion of any programs from the budget request. An $11,335,000 reduction in Construction of Facilities funding included $5 million for modification of Launch Complex 39; $4 million for Solid Rocket Motor test facilities; and an unspecified cut of $2,335,000. The reduction of $9,624,000 in Research and Program Management funding was recommended by the Senate and House Appropriations Committees as a "belt tightening" measure.

NEW HEADQUARTERS APPOINTEES

During the month of September, several appointments to the NASA Headquarters staff were made.

Lt. Gen. Duward L. Crow, USAF, Ret., was named Assistant Administrator, Office of DOD and Interagency Affairs and Special Assistant to the Administrator. He succeeds Gen. Bruce K. Holloway, USAF, Ret., who retired from NASA in August.

Earl L. Ginyard has replaced Donald Lichty as Headquarters Equal Employment Opportunity Officer. Mr. Ginyard, who joined NASA in April, 1974, as Manager of the Equal Opportunity Professional Recruiting Office, also will serve as Special Assistant to the Associate Administrator for Center Operations.

PLANS FOR ASTP FLIGHT CONTINUE TO PROGRESS

Fletcher Reports Soviet Assurance of No Connection with Abruptly Ended Soyuz 15 Mission

Dr. James C. Fletcher, NASA Administrator, has issued a formal statement in response to questions as to whether the Soyuz 15 flight, staged by the Soviets early last month and which ended abruptly after two days, was in any way connected with the Apollo-Soyuz Test Project (ASTP) mission scheduled for next July.

His statement follows;

"NASA personnel engaged in the Apollo-Soyuz Test Project were informed in advance by Soviet personnel of the Soyuz 15 flight and its approximate timing.

We were specifically informed in the case of both Soyuz 14 and 15 that they have no direct relationship to ASTP. Neither, for example, has carried the ASTP docking mechanism. We have no reason to doubt this information.

"Reports that Soyuz 15 was a precursor of ,ASTP and that the crew was a backup crew for that flight are, to the best of our knowledge, completely erroneous.

"The last Soviet manned flight known to be related to ASTP was Soyuz 12 which was a successful flight. We are informed by the Soviet side that there will be no further Soyuz flights directly related to preparations for ASTP ."

In another development concerning ASTP, it was announced that all major flight hardware items for the joint US-USSR mission, with the exception of the docking module, are now on hand at Kennedy Space Center. The docking module is undergoing thermal and vacuum tests at the Johnson Space Center in readiness to be moved to KSC to enter the processing flow late in October.

The various stages of the Saturn IB rocket selected for ASTP have been in environmentally-protected storage for some months. Arrival of the Apollo command/service module on Sept. 8 virtually completed the list of flight hardware items to undergo processing at KSC.

The S-IVB second stage for the Saturn IB, which will launch the spacecraft, was moved from its storage "cocoon" in the Vehicle Assembly Building on Sept. 3. It will undergo a corrosion checkout and then begin normal processing.

Launch of the Apollo spacecraft, with its three-man crew of Astronauts Thomas P. Stafford, Donald K. Slayton and Vance D. Brand, is scheduled for 3:50 p.m. EDT July 15, 1975. It is to effect a rendezvous and docking with a Soviet Soyuz spacecraft carrying Cosmonauts Aleksei Leonov and Valeri Kubasov which will have been launched seven and a half hours earlier from the Baikonur cosmodrome to the northeast of the Aral Sea.

A major program objective of ASTP includes the development and test of compatible rendezvous and docking equipment and procedures. A major goal of the mission will be the performance of 26 space experiments, five of them to be accomplished jointly by the astronauts and cosmonauts during the joint phase of the mission.

Earth observations will be a major part of the work of the Americans. As on the Apollo and Skylab missions, they will take pictures and record their comments about the Earth as they observe features ranging from weather phenomena to volcanoes during the 10-day flight.

The human eye's ability to distinguish dimly as well as brightly lighted objects, its extreme sensitivity and the observer's vantage point in space will permit a better understanding of physical phenomena, it is pointed out.

Types of features considered for study on the mission include:

Studies of major active strike-slip fault zones in both eastern and western hemispheres and identification of extensions of fault systems by studying vegetation or drainage patterns.

Studies of closed-basin circulation and shore lines, as well as snow cover studies to be used later in conjunction with photographs taken of the Himalayas and hydrological studies of photographs taken over Indian plains and land areas inundated by rivers.

Studies of ocean upwellings and their hydrological and biological effects and of major trends of the ocean currents.

Visual observations of tropical weather problems such as frontal waves, tornadoes, storm centers and localized atmospheric circulations.

Along with prize-winning cattle, home-canning and midway attractions, visitors to numerous regional fairs in the Marshall Space Flight area will be able to view exhibits on space this fall. The Center provides exhibits throughout Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Missouri and Iowa.

PRESIDENT FORD GREETS ASTP COSMONAUTS AT WHITE HOUSE

Invites Them to Picnic of Hotdogs and Crabs in Nearby Virginia

President Ford gave Soviet cosmonauts working on the Apollo-Soyuz Test Project a taste of typical American hospitality—complete with hotdogs and hardshell crabs—when they stopped off in Washington early in September before going to the Johnson Space Center for further project training.

Included in the group were Cosmonauts Aleksei A. Leonov and Valeri N. Kubasov, the Soviet crew for the Soyuz linkup with an Apollo spacecraft next July, and Maj. Gen. Vladimir Shatalov, chief of the cosmonaut corps. They were met here by Soviet Ambassador Anatoliy Dobrynin and by the three American ASTP astronauts, Thomas Stafford, Vance Brand and Donald K. (Deke) Slayton.

President Ford first greeted the space men, with the Ambassador and Dr. George M. Low, NASA Deputy Administrator, at the White House. Recalling that he was in Congress at the time NASA was established, he told his visitors that he had "a very deep and long interest in our space aviation programs."

"I think it a very wonderful program," he added, "both for the Soviet Union and the United States, and I know it has been a great program for the world as a whole. Most Americans, and I suspect most citizens of the Soviet Union, do not appreciate the spinoff, the benefits that go to the people as a whole, whether it is medical or scientific or any one or the other.

Nations Working Together

"So what you have done in the Soviet Union and what these American astronauts have done for our people has far broader benefits than just being in space. But, in addition—and I think this is the most significant part of this gathering here today—is the fact that you from the Soviet Union and these three astronauts from the United States are working together, working together for mankind as a whole, working together to show that different societies can work on scientific programs that are greatly beneficial to all."

He said he looked forward to the joint mission next July.

The President invited all of his visitors to accompany him to the annual picnic of the Fire Department of nearby Alexandria, VA, where he lived before occupying the White House. There they were treated to hotdogs, crabs, and other delicacies.

Speaking of the ASTP project in a brief talk at the picnic, the President said it was not only a tremendous technological achievement, but "it is, I think, far broader in its implications and ramifications" for the world.

"We as Americans," he continued, "are very proud of our country. Our friends from the Soviet Union are very proud of their country. And our two countries in very recent years have sought to work together in space and in the environment, in medicine, in many fields, including an effort to resolve differences in strategic arms.

"I think all of us agree that the broader we can make our relationship in health and environment and space and many other areas, the better it is for us here in America and our friends in the Soviet Union."

DR. DEBUS TO RETIRE

Dr. Kurt H. Debus, who has served as Director of Kennedy Space Center since its establishment in 1962, has requested retirement at an early date.

Dr. Kurt H. Debus

Expressing regret over his retirement, Dr. James C. Fletcher, NASA Administrator, said: "Kurt Debus is one of the outstanding pioneers in space exploration.

His record stands on its own—from the launch of the first American satellite in 1958 to building and operating the great launch complex at Cape Canaveral for the Apollo manned lunar landings. His leadership at the Kennedy Space Center was a key factor in this nation's achievement of space supremacy and preparation for Space Shuttle and other future programs designed to exploit space for the benefit of mankind."

Pending selection of a successor, Miles Ross, Deputy Director, will function as Acting Center Director.

In a letter to KSC employees, Dr. Debus reminded that he was retiring at a time when the installation's future has been assured and construction is underway to accommodate the Space Shuttle transportation system in the 1980s.

Dr. Debus' career in military and space programs in the U.S. began in 1945 at Fort Bliss, TX, and White Sands, NM, where the U.S. Army was conducting research activities. In 1950, with Dr.

INFORMATION AGREEMENT—A Public Affairs delegation headed by Assistant Administrator John P. Donnelly (seated right) initialed an agreement on ASTP information policy in Moscow during September. With Donnelly as members of the U.S. delegation were Robert Shafer (far right), Deputy Assistant Administrator for TV, and Jack King (second on Shafer's right), Chief of Public Affairs at JSC. Chief USSR negotiator was V.S. Vereaschetin (seated left), Vice Chairman, Intercosmos, USSR Academy of Sciences.

Wernher von Braun and others, he moved to Huntsville, AL, where the Army consolidated its missile development projects.

He supervised the construction of Army launch facilities at Cape Canaveral and the launch of the first Redstone ballistic missile in 1953. He later supervised flight testing of Jupiter, Jupiter C, Juno and Pershing missiles until the Army team was transferred to NASA in 1960.

On Jan. 31, 1958, he directed the launch of the first U.S. Earth satellite, Explorer I. He then supervised construction of the Kennedy Space Center while directing activities of the launch center through the entire manned and unmanned programs from the flight of Astronaut Alan Shepard in 1961 to preparations for Space Shuttle operations.

A native of Frankfurt, Germany, he has received numerous honors and awards, including NASA's Distinguished Service Medal.

REPAIR IN SPACE STUDY

Methods by which man may assemble, repair and maintain spacecraft in earth orbit is the subject of a study contract awarded by NASA to the Martin Marietta Corp. of Denver, CO.

Under the contract, Martin will investigate, further develop, and assess the technical and operational concepts for manned and automated assembly of space systems during the Space Shuttle era of the 1980s and 1990s.

The 12–month, $300,000 contract also calls for the corporation to identify the technical and operational feasibility, relative effectiveness, cost factors, and other significant trade-offs and sensitivities involved in the various methods of performing these functions in order from the Space Shuttle Orbiter.

NASA also has requested the corporation to consider the use of manipulative devices now planned in the Orbiter's 60–foot-long cargo bay, as well as use of the "Buck Rogers" type astronaut maneuvering unit successfully operated during the recently-concluded Skylab program. In addition, the study will include use of simple docking or mating systems for the assembly of modular space systems in orbit.

Martin will also analyze the varying degrees of human skills and dexterity, as well as identify what projected state of the art or other ancillar equipment will be required to perform man's first major in-space assembly, maintenance and repair work.

STORM REFUGEES—Part of the more than 7,000 refugees from Hurricane Carmen fed by the National Space Technology Laboratories.

EMERGENCY TEAM AT NSTL HOUSES STORM REFUGEES

Cares for More Than 7,000 Persons During Hurricane "Carmen" Threat

POSTCARMEN APPRECIATION

Though "Carmen" soon shifted, avoiding our door,
Her cousin "Camille" had paid call before;
And the lesson she'd taught us had seemed to mature
Into organized effort that made us secure.
By Edith Taylor, NSTL Secretary

The National Space Technology Laboratories (NSTL) in Hancock County, Mississippi, playing a double role in both tracking the storm and caring for residents affected by it, departed from its customary week-end prosaic routine and hosted more than 7,000 refugees when Hurricane "Carmen" posed a dangerous threat to the area the morning of Sept. 7.

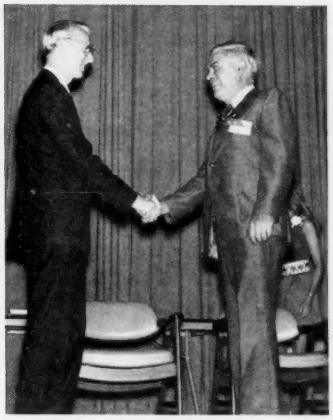
When "Carmen" took aim on the Mississippi-Louisiana coasts with her more than doubled winds of hurricane force, NSTL swiftly put its experience-inspired emergency plan into effect and rallied its manpower into a 175–member Emergency Team.

What took place there was described by John Worcester, Division Representative of the Gulf States Division of the American Red Cross as "the best managed and handled emergency shelter I have ever worked with." The entire operation was "one of unequaled professionalism," he said.

The NASA installation had sheltered 1,600 refugees during an earlier hurricane, "Camille," but Mississippi Gulf Coast residents were "taking no chances this time," they said. Everyone remembered too well the fury of "Camille" when she smashed into the area during the night and early morning hours of August 17–18, 1969, claiming hundreds of lives and causing property damage estimated in millions of dollars. Many inhabitants who ignored warnings to evacuate during the storm lost their lives, and many who did seek shelter returned to find their homes destroyed.

During the "Carmen" threat, in addition to the thousands of refugees who flocked to NSTL, 12 Navy ships from New Orleans, boats from the Louisiana Sports Fisheries and Wildlife Bureau and 75 private shrimp, oyster, fishing and pleasure boats took shelter in the installation's canals and harbor.

Some 19,000 meals were furnished by the Red Cross. Special care had to be given the sick and infirm. More than 100 youngsters were deputized to help in providing creature comforts, maintaining order, babysitting, busing in the cafeteria, and maintaining cleanliness.



WEST COAST AWARD CEREMONIES—Both Ames Research Center and the Jet Propulsion Laboratory recently presented awards in recognition of contributions to the highly successful Pioneer 10 and Mariner-Venus-Mercury '73 space probes. In the photo at left, Dr. James C. Fletcher, making his first visit to Ames for an award ceremony, congratulates Charles F. Hall, Project Manager for Pioneer 10, after presenting him with NASA's Distinguished Service Medal. At right, Walker E. (Gene) Giberson of JPL, the Mariner-Venus-Mercury Project Manager, is congratulated by Dr. William H. Pickering (right), Center Director, and Dr. Harold Brown, President of Caltech, while Dr. Fletcher (right), Dr. John Naugle (behind Giberson) and Robert S. Kraemer look on.

A standby recovery team remained ready to go into local communities if needed.

Throughout the week-end operation, contact was maintained with local government officials, Civil Defense organizations and the Mississippi and Louisiana State Police. Mississippi Governor William Waller and U.S. Senator John Stennis were also tuned in to the NSTL communications network, which received more than 11,000 calls during the alert.

NASA Headquarters offered assistance and was kept informed of the changing situation.

Henry Auter, NSTL Deputy Manager who served as Emergency Director, had this to say of the operation:

"We are especially appreciative of all the help we received from the communities and the concern expressed by our Headquarters and other federal and state agencies. The refugees were most cooperative. It was a real demonstration of community spirit in action during a pretty difficult period."

In citing the men who worked with the Emergency Team during the long hours of the week end, Jackson M. Balch, NSTL Manager, said:

"The reputation of this facility as a 'good neighbor' in our communities was considerably enhanced by the accommodations which we provided to those seeking shelter from the hurricane. The numbers of people and special situations placed requirements on us that far exceeded our expectations."

STUDY FOR AERONAUTICS PLANNING IS LAUNCHED

Space Agency Looks Ahead on Activities for Years from 1980 to 2000

NASA has embarked upon a comprehensive planning study called "Outlook for Aeronautics" to assess the role of aeronautical development in the period 1980–2000. The study will encompass considerations of the probable and possible future directions of civil and military aviation, the technological advances that will permit such future directions to be followed, and the role that NASA should play in aeronautical development in this period.*

All possible endeavors deemed desirable and practical for the advancement of aeronautics will be examined.

Dr. James C. Fletcher, NASA Administrator, has called for a far-reaching and imaginative effort, and has urged all NASA employees to contribute ideas and comments. (See LETTER FROM WASHINGTON on Page 2 of this issue of NASA ACTIVITIES.)

A group consisting of personnel from NASA Centers and Headquarters, the Federal Aviation Administration and the Department of Defense will conduct the study, with the assistance of

NASA Center personnel, and prepare planning options for NASA Aeronautical Programs in the time period 1980–2000.

Objectives

1. To survey the views of industry, NASA, Congressional staffs and other governmental agencies to determine:

(a) The probable and possible future directions of aeronautical development for the remainder of the 20th century.

(b) The technological programs that must be conducted to provide the springboard for such developments.

(c) The most useful role of NASA in aeronautics and the relationships that must be cultivated between NASA and other government agencies and the aerospace industry to effect this role.

2. To provide a source book of information that will serve as a basis for future aeronautical program formulation within NASA.

3. To describe "scenarios," technology directions, and program plans and policies that will guide NASA's future aeronautical research and development.

Topics to Be Considered

The areas to be considered in the study will include, but are not limited to, the following:

1. Future Directions.

(a) Civil short haul and long haul air transportation.

(b) Use of aircraft for exploration, resource development, and utility purposes.

(c) Tactical and strategic air defense.

(d) Military air mobility and air transportation.

(e) World market competition in aircraft and aviation products.

2. Technical Programs.

(a) Programs to achieve greater aerodynamic, propulsive, and structural efficiency, reduce aircraft fuel consumption, and make more effective use of control systems that will result in new aircraft concepts and major improvements in civil and military aircraft design.

(b) Programs to achieve advances in navigation and guidance, avionics and operational procedures, and to achieve reductions in noise pollution and fuel consumption that will make possible significant improvements in, and expansion of, civil and military air transportation.

(c) Programs to demonstrate, in ground facilities and in flight, new vehicle concepts and operating modes that may have a significant impact on future aeronautical development in the U.S.

NASA's Role in Aeronautics

NASA's research and technology role in aeronautics is related to:

- Technical support of DOT/FAA programs in aircraft certification, noise reduction, and air traffic control systems development.
- The needs of the National Transportation Safety Board.
- Cooperation between NASA and the U.S. aerospace industry to provide sufficient research and technology developments to assure U.S. leadership in civil aviation.
- Requirements identified by DOD.

Organizational Considerations

1. Members of the Study Group will spend between 20 and 30 per cent of their time over a 10–month period to complete this study. Such an arrangement permits the involvement of those NASA managers directly responsible for the conduct of aeronautical R&D within NASA. The Study Group will be organized into panels supported, as and when needed, by a staff comprising knowledgeable individuals from the NASA centers.

2. The Study Group will report to the Associate Administrator of the Office of Aeronautics and Space Technology. The NASA Administrator, Deputy Administrator and Associate Administrator will also interface with the Study Group. Management will review progress and provide additional guidelines at major milestones during the study.

3. The primary involvement of non-NASA people will be through visits to and discussions with industry and other agencies. However, consultants from industry and other government agencies may be invited to participate in preparing and reviewing final plans.

4. The Study Group has the support of the Directors of NASA field centers who will participate in the review process and will provide suggestions for improvement of the study effort.

Overall Schedule

The study has two phases. They are (a) preparation of source material based on extensive discussions within and outside the Agency and (b) preparation of planning options supported by analysis and trade-off studies. Formal reviews will be con-

ducted by NASA management at the conclusion of each phase and at appropriate intermediate points as necessary.

Study Group Membership

The following are members of the Study Group:

Dr. Leonard Roberts (Chairman), Director, Aeronautics and Flight Systems (ARC).

Mark H. Waters, Chief, Aeronautical Systems Branch (ARC).

Richard Kurkowski (Executive Secretary), Research Assistant for Aeronautics, Flight Systems Research Division (ARC).

Robert Power, Director for Aeronautics (LaRC).

Thomas Toll, Acting Chief, Aeronautical Systems Office (LaRC).

Richard Weber, Head, Mission Analysis Branch (LeRC).

Warner L. Stewart, Chief, V/STOL & Noise Division (LeRC).

Melvin Burke, AST Technical Manager (FRC).

Bruce G. Jackson, Chief, Engineering Analysis Division (JSC).

William S. Aiken, Jr., Director, Transport Technology Programs Office, RT, (HQ).

Col. John M. Coulter, Director, Interagency Relations (WR), (HQ).

Gerald G. Kayten, Director, Study and Analysis Office, RX, (HQ).

David Sheftel, Acting Director, Office of Aviation Policy, FAA.

DOD representative, to be named.

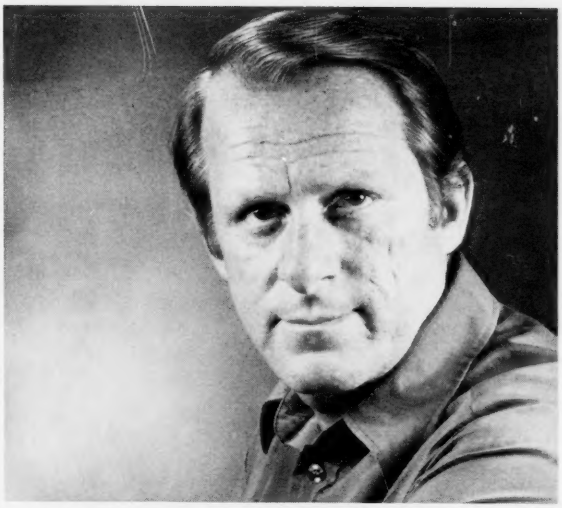
* *(For details on the planning study called "Outlook for Space, see NASA ACTIVITIES for September 15, 1974.)*

GORMAN GETS NEW POST

Harry H. Gorman, Deputy Associate Administrator for Manned Space Flight (Management) since 1970, has been appointed Special Assistant (Program Support) to Joseph F. Malaga, Assistant Administrator for Institutional Management.

In his new position, Gorman will work directly with Malaga in the implementation of the Institutional Management System at the Johnson, Kennedy and Marshall Centers, the last of which will be his duty station.

Gorman came to Headquarters from Marshall, where he served as Deputy Center Director (Management) for nine years. His previous Federal service also included 10 years with the Atomic Energy Commission.



PAINTING IN GALLERY EXHIBIT—"Closing In," a watercolor by James Dean (above), Deputy Director of Planning and Media Development and Director of NASA's Art Program, has been included in the 19th Area Exhibition of the Corcoran Gallery of Art in Washington, DC, to be open to the public from Oct. 12 to Nov. 10. The painting shows a portion of a barn in Virginia shortly before its destruction to make way for suburban growth.

SPACE REPAIRS ALMOST LIMITLESS

"Essentially any repair or maintenance that logistically fits an operations activity can be performed in Space," Robert E. Pace, Jr., of the Marshall Space Flight Center recently told the American Astronautical Society.

Pace, Deputy Director of MSFC's Materials and Processes Laboratory, added that the design of future spacecraft should acknowledge "this almost limitless capacity" and provide for more extensive inflight repair and maintenance by men.

His paper was based on the Skylab program in which astronauts made unplanned repairs and alterations to major system elements.

MSFC EMPLOYEES IN ENGLAND

Two employees from Marshall Space Flight Center were in England during September to take part in payload integration activities on the joint U.S.-British astronomy project, Skylark SL 1115.

Richard B. Hoover, co-investigator, of MSFC's Space Sciences Laboratory, and James W. Patterson, Jr., design engineer of the Space Shuttle Office, worked at the Mullard Space Science Laboratory in London.

The Marshall Center assembled the payload, an X-ray telescope, which will be launched by a British Skylark sounding rocket in June, 1975.

REWARDING INITIATIVE—In the first ceremony NASA Headquarters has held to recognize individual initiative on the part of its employees, Hazel P. Combs, Secretary, Life Sciences Committee, Space Program Advisory Council, receives a plaque from Dr. James C. Fletcher, NASA Administrator, as Dr. George M. Low, Deputy Administrator, waits to congratulate her.

NASA HEADQUARTERS BEGINS INCENTIVE AWARDS PROGRAM

21 Employees Are Recognized by Committee In Initial Honor Ceremony

After 16 years of existence, NASA Headquarters, like most of the agency's installations, has taken steps to give special recognition to individual initiative among its employees.

Twenty-one men and women members of its personnel were presented awards by Dr. James C. Fletcher, NASA Administrator, at a special ceremony in the Headquarters auditorium on Sept. 25. Congratulations also were extended at that time by Dr. George M. Low, Deputy Administrator.

The ceremony was presided over by Edwin C. Kilgore, Deputy Associate Administrator for Center Operations. At its close, brief remarks urging continued interest in the program were made by William C. Schneider, Deputy Associate Administrator of the Office of Manned Space Flight and Chairman of the Incentive Awards Committee.

The recipients had been chosen by the committee on the basis of nominations submitted by employees throughout Headquarters, with the only stipulation that a nominee must have been in a permanent position at NASA for at least one year.

"It gives me personal satisfaction," Dr. Fletcher said before beginning the presentations, "to have a part in this first award ceremony that is strictly a Headquarters affair. I have always considered it highly important to recognize and encourage individual initiative, especially in any large undertaking such as the space program, and that is what we are trying to do today.

"We have failed, largely through oversight, to pay proper attention to achievements of the Headquarters personnel. Hopefully this ceremony will initiate a process to correct that omission and establish a meaningful honorary awards tradition here in our central office."

The Administrator gave a brief recap of the activities that took place on the Headquarters calendar during the last year or so, going back to July, 1973, and closing with the remark: "We are functioning as a sound agency."

He continued: "I have reviewed these activities to give you an idea as to why we are holding this ceremony today and why we want to recognize and praise those who have been selected to receive

these awards. In an agency such as NASA, an important and certainly a forward-looking part of our government, we are sometimes prone to think only of those at the top of a program and to overlook the individuals actually involved in getting the work done. These latter, however, when their efforts are linked together, comprise a conspicuous part of the space picture. For us to succeed, each employee must live up to his responsibility, no matter how much out of the limelight he or she may be. We hope this spirit will be encouraged by the award ceremonies we thus are initiating."

Awards were made in these four categories:

Exceptional Performance Award—presented in recognition of demonstrated individual initiative in effecting an outstanding accomplishment in support of NASA's scientific, engineering, technical, or administrative activities at Headquarters.

EEO Achievement Award—presented to employees in recognition of outstanding leadership, skill, imagination and initiative, which have resulted in significant contributions to equal employment opportunity in the government.

Space-Ship Earth Award—given to employees in recognition of outstanding off-the-job contributions which significantly affect the quality of life on Space-Ship Earth, especially in the local, regional, or state community.

Creative Management Award—recognizing supervisors whose rapport stimulates or fosters a noticeably improved quality performance by his staff.

Winners follow:

Exceptional Performance Award—William O. Armstrong, Kathleen A. Bond, Roy L. Bullock, Richard L. Cepela, Charles W. Childs, Hazel P. Combs, Carl H. Dry, Richard M. Farrell, Peggy A. Gatewood, Edmond J. Golden, Virgil C. (Pat) Jones, David M. King and William P. Taub.

Equal Employment Opportunity Award— Bernard F. Carey, Jo-Marie DiMaggio and Lynda Faye Sampson.

Space-Ship Earth Award—Paul R. Brockman, George W. Morgan and Dr. Charlotte V. Silbaugh.

Creative Management Award—Niel F. Lamb and Harold E. Pryor.

WARDEN NAMED CHIEF COUNSEL

John H. Warden, a member of the NASA Board of Contract Appeals, has been appointed Chief Counsel of the NASA Pasadena Office, succeeding Philip Travis, who has retired.

Warden has served on the Board of Contract Appeals since 1971 and was on the staff of the Office of General Counsel from 1970 to 1974. Other assignments in NASA have included Patent Counsel, Lewis Research Center, 1959 to 1960; Patent Counsel, Marshall Space Flight Center, 1960 to 1962; and Chief, Patents and Technology Utilization Division, Pasadena Office, 1962 to 1970.

Before joining NASA, he was a Patent Advisor for the Naval Ordnance Laboratory, Corona, CA. He also served as a Patent Examiner with the U.S. Patent Office for four years.

MAN'S ROUTINE IN COLONIZING PLANETS OUTLINED BY FREITAG

NASA Official Sees Permanent Space Stations as Next Step Toward Occupancy

The procedure he believes man will follow in colonizing the other planets was described by Captain Robert F. Freitag (USN, Ret.), Deputy Director of Advanced Programs, Office of Manned Space Flight, in a keynote address delivered at the 32nd World Science-Fiction Convention, held in Washington recently.

Capt. Robert F. Freitag

Terming the Space Shuttle "the Wright Brothers' Kitty Hawk airplane of the Space Age, he said the next move will be to achieve permanent occupancy of space with permanent space stations as a step toward large bases.

Using as a topic "Space Travel—the Nonfictional Approach," Captain Freitag's discussion centered around a review of fictional space predictions which have become realities, supporting the adage that fact is stranger than fiction.

"In my crystal ball," he said, "I glimpse manned orbital facilities—space stations of modular (or building-block) design and ever-increasing size, each building block launched by the Shuttle and its next generation offspring.

"I see both earth-oriented applications and space-oriented operations, explorations and adventures. For example, there will be a manned earth resources observatory in orbit. The observer is sitting in what looks like a B-29 bombardier's turret and devotes long duty periods, perhaps four hours at a stretch, to taking any valuable data he sees. The ground keeps him updated on weather and new target possibilities. Such a program would

greatly increase the value and quantity of earth resources observations data."

Captain Freitag predicted there also will be giant reflectors, which he described as mirrors for microwave energy in geostationary orbit.

"Large amounts of energy might be transmitted from one point on Earth to another by bouncing microwaves off the orbiting reflector, eliminating the need for earth-bound transmission means such as cable, fuel tank cars and ships, even pipelines," he added. "There will be solar power collectors in orbit to transform vast amounts of solar energy into electric energy for use on Earth."

Looking to the Future

These ideas he identified as some the space agency now is looking at in order to chart a space program for 1980–2000.

"This study, called 'Outlook for Space,' " he said, "is evaluating potential operational and commercial uses of space. In particular, we are considering such typical activities as the future of astronomy, astrophysics and other space sciences, manned bases and laboratories in earth orbit, on the Moon and planets, and space colonization, terrestrial communications and information transfer, monitoring and management of terrestrial weather and environment, space processing and manufacturing, use of space for terrestrial energy supply, interstellar probes, planetary exploration, and the research for intelligent extraterrestrial life.***

"Of course, the possible existence of extraterrestrial life, preferably intelligent, and the ramifications of its possible discovery are one of science fiction's most treasured subjects. At a time, a generation ago, when almost all scientists would have pooh-poohed the idea of other life forms in the universe besides what we know here on Earth, science fiction writers of great imagination were already far into exploring the fabulous technological, social, philosophical and humanistic impacts of finding such beings—largely in those science-fiction yarns classed as 'first encounter' stories.

"Today, many scientists—if not the majority —agree that extraterrestrial life surely must exist and possibly in enormous abundance. They even do not shrug off any longer the possible existence of intelligent life in our galaxy.*** The question now is no longer so much one of 'if' as of 'where'."

He described the search for life in the universe and the origin of life as one of NASA's most important goals in its science program and the main thrust behind its planetary exploration projects —past, current, and future.

Exciting Space Advances

"You know," he said, "the current year of 1974 has truly been an exciting time for a space buff to be alive! Since the beginning of this year, mankind has visited four planets in the solar system —Jupiter, Venus, Mars and Mercury. I think the only comparable period of exploration took place in the 100 years or so after the discovery of the New World in 1492.

"NASA's first interplanetary robot Explorer reached Venus 12 years ago (1962), surprising us—and disappointing many—with the finding of a searing surface temperature of 800 degrees Fahrenheit. We reached Mars in 1965, returning the first 20 photos of that planet's surface, which showed that it was cratered. Mariner 4 also brought us the second disappointing surprise that Mars had atmospheric conditions detrimental to most earth-type life, and neither magnetic field nor radiation belt. Many people started to ask: Was our planet Earth maybe unique in the universe? What if we are alone? Was truth indeed turning out to be stranger than fiction?

"We followed Mariner 4 with Mariners 6 and 7 in 1967, and they verified that Mars' atmospheric pressure for the surface was less than one-hundredth that of Earth—and not a tenth, as believed by scientists and science-fiction writers before that time. Also, there were no canals on Mars.***

"But Mars, in spite of the craters, was not a dead planet! We found this out the hard way when our deep-space probe Mariner 9 arrived at Mars right in the midst of the most spectacular dust storm ever recorded. The entire planet was covered with dust! This, too, had never been anticipated in fiction quite like that. After the dust cleared and the sand settled, we discovered three of the largest volcanoes known to man, a gigantic rift valley running around its equator, and countless strange features that looked very much like ancient stream beds.

Mars May Have Life

"There also may be life on Mars, after all—even if its climate is too harsh for other than rudimentary life forms. The fact that we have not found it yet has no meaning, for 'absence of evidence is not evidence of absence.'

"All of a sudden, we have a new and exciting Mars on our hands. Our scientists mapped the entire surface of the Red Planet with Mariner 9, made a geological analysis of it, and selected four

landing sites for our next major step in the exploration of Mars—Viking.

"NASA is in the final development and testing stages of this ambitious program which will culminate in the landing of two large robot spacecraft on the dusty, windswept surface of Mars in the summer of 1976—truly a fitting tribute to the 200th birthday of this great nation.

"Prime landing site is at Chryse, at the northeast end of a giant 3,000-mile-long, 20,000-foot-deep rift canyon. Each of these machines weighs nearly four tons and represents a combination biological and chemical laboratory. Each one is entirely self-contained and powered by two nuclear energy generators. They represent mankind's most advanced technology. Their mission: search for life!"

Two questions—"Who is out there?" and "What is out there?"—are providing a major thrust also toward the outer planets of the solar system, he said, continuing:

"Six months ago, in March, we received our very first pictures from the planet Mercury—1,700 of them!—when Mariner 10 swept within 400 miles by that small, hot, moon-like world. They showed craters, highlands and maria with a solution of down to 100 meters. Before that, in February of this year, the robot Explorer had transmitted over 4,000 television pictures from Venus, gliding within 3,600 miles by that mysterious planet which may provide the clues to the mysteries of our own weather system.

Search Continues

"The search goes on. Late in the Sixties, we realized in NASA that Jupiter, in addition to being a most interesting planet, was the gateway to the outer planets and the galaxy. Thus, on March 2, 1972, one of the all-time greatest adventures in the history of exploration began with the launch of the spacecraft Pioneer 10.

"Traveling a billion kilometers through space, the robot machine reached Jupiter last December, tickling that giant dragon's tail and very much feeling the hot breath of radiation from the dragon —hot enough to bring us right to the brink of what our present technology can take. Overflying its brightly-colored cloud bands at 81,000 miles altitude, the robot transmitted more than 300 color pictures across a gulf of half a billion miles. The power of its radio signals when received on Earth was so weak that it would have lighted a 7.5-watt Christmas tree bulb for one-thousandth of a second—after having been collected for 19 million years!

"Imagine! Pioneer 10 has traveled farther and faster than any other man-made object. It will continue its incredible voyage through the solar system for the next five years, and it may continue to transmit from as far out as Uranus' orbit, almost two billion miles away. After crossing Pluto's orbit in 1987, it will become the first man-made object to escape the solar system and to penetrate into interstellar space, headed out on a straight-line course at a permanent 25,000 miles per hour toward the constellation Taurus. In some 1,700,000 years, it should pass the star Aldebaran (or Alpha-Tauri) at a distance of 53 light years. Pioneer 10 may have its first encounter with another civilization. What strange events may then take place, what strange reactions will it cause?

"The spacecraft has been compared to a toy that the infant throws out of his crib as he prepares to grow up and welcome life; it has also been called our collective epitaph and tombstone which will tell the universe about us long after mankind and the solar system are gone.

Plaque Carries Message

"As you surely know, there is an aluminum plaque aboard the robot messenger on which is written very clealy—not in English or Esperanto, but in scientific—which star of the 250 billion in our galaxy sent this greeting card, in which year in the 10-billion-year history of our galaxy it was sent, and what type of strange creature sent it. Imagine!

"Later this year, Jupiter will again be visited by another superpathfinder, Pioneer 11, which will then fly on to encounter and explore the planet Saturn in 1979. It also will continue its epic journey into galactic space, and it also carries our greeting card from Earth."

Citing that the enthusiasm for planetary exploratory missions continues to grow in the scientific community, Captain Freitag reported that two more Mariner flights to Jupiter and Saturn are planned for 1977. They will use all-nuclear power like Pioneers 10 and 11 and will carry more than 80 kilograms of instruments. Their mission will include the reconnaissance of three of Saturn's satellites—Titan, Rhea, and Dione.

He revealed that two Pioneer machines will streak to Venus in 1978, to orbit the shrouded planet and study its carbon-dioxide atmosphere with probes. Orbiters, landers and automated rovers to the planets will follow in the Eighties, he reported.

If no life is found on Mars in 1976, he said he believed mankind would still be greatly interested in the planet because it is most likely to support life, as the Earth does.

"Yes," he added, "I think we will then want to begin a really cosmic experiment to see if we can somehow transplant life from the Earth to Mars."

Population Growth Questionable

He turned next to the subject of philosophy:

"I see two very striking facts about our world of today—one is the explosive growth of the world's population in the 20th Century, and the other is the advent of space exploration. I feel intensely that these two events do not coincide in time by accident. Some inner motivations are leading mankind to new and unknown shores, and therefore we are gathering our strength and reorganizing our social structures. You see, life is a force which has persisted on Earth for two to three billion years—which has spread across this planet like a grass fire—which has already gone out to touch the Moon and is even now stretching its sensors out toward the galaxy. This life will survive for many millions of years more—and to do so it will continue to expand and to weave its way out. Almost instinctively, man will follow this push and settle on other planets.

"Thus, our population explosion may not be a bizarre mistake of nature at all, as some claim; it may be a necessary preparation for space travel as part of our destiny, maybe because the solar system could probably not be conquered with a mere three billion human beings.

"And thus, we in NASA are convinced beyond doubt that man will colonize the planets. *When* we will start this, whether it will be in 1984 or 2001, or whether it will be done by the United States or the Soviets or as a joint project involving many nations, I don't know. But I am profoundly sure that man himself will go out on these great voyages."

Steps to Reach Other Planets

Captain Freitag gave this procedure for men to follow in colonizing the other planets:

"First, we will probably return to the Moon and establish a base station there, much like the scientific research stations now in existence in the Antarctic. The space transportation system presently under development will have the flexibility to support these lunar missions with a minimum of additional developments required.

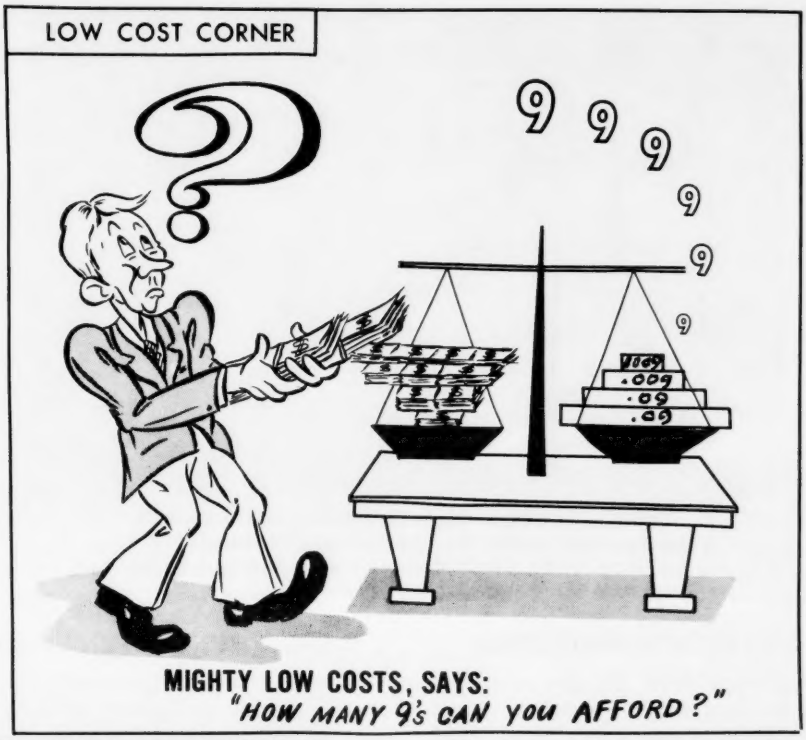
"The next step will be Mars. Unlike the Moon, Mars will eventually attract permanent settlers intent on colonizing that dynamic world. And our present-day Shuttle might then take its rightful place next to the 'Spirit of St. Louis' in the Smithsonian.

"After the first foothold has been gained, planetary mining and manufacturing experiments will be carried out. Using laser-fusion power, planetary engineers will find ways of mining the planet for resources. They will begin manufacturing the necessary consumables like oxygen, water, food, and fuel. After having reached a certain independence from earth-based logistics, the colonization project may then move into the phase of environment modification (or planet-forming, as it is called in science fiction, I believe). Large enclosures will be constructed of new space-developed materials, and a more earth-like environment will be created. By then, the human colony will be firmly established on Mars and the first children will have been born, to become the true Martians.***

"Flight to the outer planets and their moons will then be as inevitable as the population explosion itself. We know from Pioneer 10 that Jupiter's satellites Ganymede and Io have atmospheres. Maybe they are rich in resources of value to man.

"What surprises await us at greater distances, on the moons of Saturn, for example: We don't know. But we may get an inkling in a few years when we send out new pathfinder spacecraft."

PICNICKING IN THE RAIN—Stormy weather failed to keep more than 3,000 Marshall Space Flight Center employees and retirees and their families from attending a picnic and awards ceremony on Sept. 14, the day after the retirees had held their fifth annual meeting and been welcomed and briefed by Director William R. Lucas. Music, games, shows, rides, door prizes, fried chicken, corn on the cob, and tours of selected facilities were on the picnic program.



MINORITY COUNCIL ESTABLISHED

A high-level, 18-member Minority Business Enterprise Program Council has been established at Marshall Space Flight Center to assure execution of an effective minority program in this field.

Under the chairmanship of John S. Potate, Associate Director (Management), and with Conrad Walker, MSFC minority business specialist, as Executive Secretary, the Council will participate in the development of related Center policy, reassess the minority business program objectives, and ensure that continuing emphasis and support are provided by all elements of the installation.

The Council will concern itself with the areas of minority business procurement, technical and management assistance, increased education and training of NASA personnel, and improved community relations with minority businesses.

MRS. HARRIS GETS AWARD

Mrs. Ruth Bates Harris, newly installed at NASA Headquarters as Deputy Assistant Administrator of Public Affairs for Community and Human Relations, was among four women presented the Sojourner Truth Award of the Black Women's Community Development Foundation at ceremonies at the Mayflower Hotel in Washington early last month.

The four recipients, who besides Mrs. Harris included a nun, a Congresswoman and a welfare rights mother, were selected by the Board of Directors of the Foundation from among 125 nominees.

The award is a two-foot-high sculpture of Sojourner Truth, a 19th century black spokeswoman. The recipients were praised as embodying her spirit, especially her "dignity and forthrightness."

MEETING ON SKYLAB RESULTS

A three-day conference to report scientific findings from many of the experiments conducted during the Skylab program will be held at Huntsville, AL, Oct. 30–Nov. 1, under the joint sponsorship of the American Institute of Aeronautics and Astronautics (AIAA) and the American Geophysical Union (AGU).

Five of the six session chairmen, as well as the conference general chairman, Dr. Ernst Stuhlinger, are scientists and engineers at the Marshall Space Flight Center.

The agenda will include many Skylab principal investigators in the field of solar physics, space processing of materials, Earth observations, student experiments, and the Skylab series of science demonstrations.

COMMUNICATING VIA ATS-6—This was the scene at Headquarters during the recent demonstration of ATS-6 programs. NASA Administrator Fletcher is seated at the table on stage, surrounded by TV sets.

ATS-6 PROGRAMS DEMONSTRATED

In a demonstration on Sept. 24, live television and two-way communication gave press and public a graphic picture of what the Applications Technology Satellite (ATS-6) is doing to relay health and education programs to isolated areas of the United States.

Launched from Cape Canaveral last May 30, the satellite is in a "stationary" orbit over the west coast of South America and is beaming messages to remote sections of the Appalachian region, Rocky Mountain area and Alaska, all of which were heard from during the program.

Dr. James C. Fletcher, NASA Administrator, who took part in the demonstration, reported that ATS-6 was "entirely satisfactory" and an unprecedented success.

The programs are coordinated by the Department of Health, Education and Welfare. Its Secretary, Caspar W. Weinberger, speaking by television from New Orleans, where he was called unexpectedly, said space "has come down to Earth," and that ATS-6 already is helping thousands in 19 states.

"Some day," he added, "all isolated areas of the world will have the benefit of modern technology."

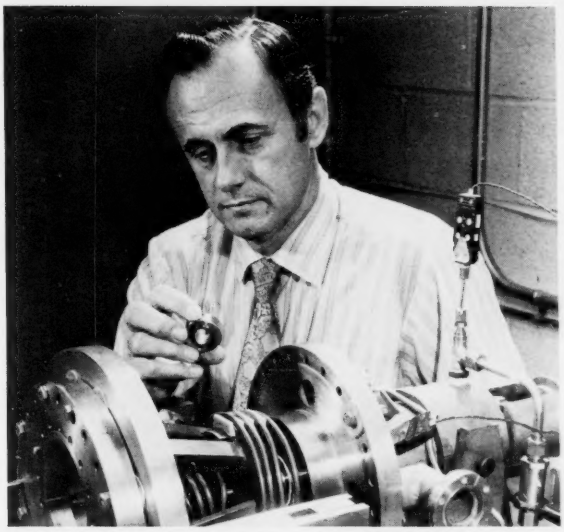
As participants interviewed during the two-way conversations with the isolated areas revealed, the programs include teacher-training courses, classroom instruction at elementary and secondary levels, medical consultations and university-level lectures.

EQUIPMENT GIVEN UNIVERSITIES

More than $12 million worth of excess technical and electronic equipment initially used in space-related projects has been permanently transferred to 53 universities in recent years from the Marshall Space Flight Center.

The equipment ranges from basic technical items such as oscilloscopes and volt meters to multi-million-dollar computer systems declared surplus to the needs of MSFC and other government agencies.

HEADQUARTERS PICNIC—The largest crowd ever, an estimated 1,100, turned out for the annual Headquarters Family Picnic held at nearby Quince Orchard, MD, on Sept. 15. A wide variety of entertainment, including this miniature merry-go-round and a radio-controlled air show put on by the Model Airplane Club, was supplied.



SIGNIFICANT NEW LeRC PRODUCTS—At left, William J. Waters (left) and John C. Freche look at new metal alloy they developed to resist high temperatures while, at right, Harold E. Sliney examines the new self-lubricating bearing material he developed and which also operates under unprecedented temperatures.

2 LeRC PRODUCTS CITED

Two products developed at Lewis Research Center have been cited by Industrial Research Magazine as among the 100 most significant new products developed during the last year. Selection was made by a blue-ribbon panel of technical judges out of some 1,000 entries from industries throughout the country.

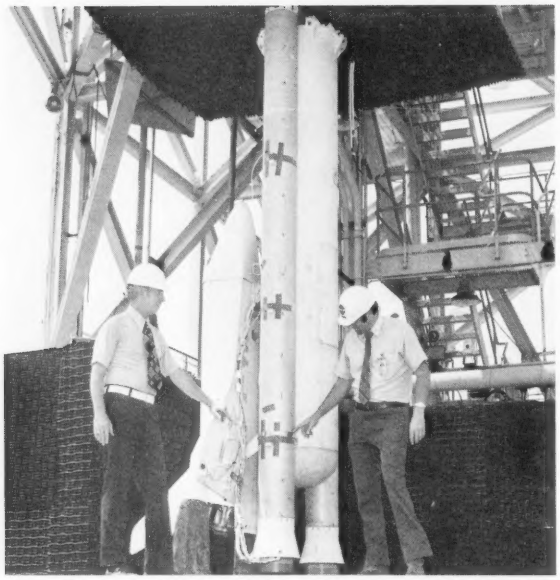
The Lewis products were a new metal alloy that has super strength at white-hot temperatures and a new self-lubricating bearing material good at temperatures up to 1,650 degrees Fahrenheit.

The high-strength alloy, the tensile strength of which at 2,200 degrees Fahrenheit is three times that of the strongest known commercial cast nickel base alloy, is the result of joint research efforts by John C. Freche and William J. Waters of LeRC's Materials and Structures Division. It can be used where high strength at high temperature, high melting point, high impact resistance, and low cost are desired.

The self-lubricating bearing material was developed by Harold E. Sliney of LeRC's Fluid System Components Division. Its principal ingredients which permit bearings to be used at high temperatures are metal, glass, and calcium fluoride.

NASA has extended an invitation for five student representatives of the Federation of Americans Supporting Science and Technology (FASST) to attend a two-day conference on "The Future of Aeronautics" to be held at the University of Kansas in Lawrence Oct. 23–24.

POLLUTION TESTER—The Mini-Sniffer, Flight Research Center's new vehicle for testing pollution in the upper atmosphere, was flown in a straight line for a distance of three miles at an altitude of 50 to 100 feet on its first flight. It was controlled by radio commands from the truck in the background. After modifications, the Mini-Sniffer will be launched from a catapult and will go up to altitudes of 70,000 feet.



SHUTTLE MODEL—Guy Perry (left) and Erskine Donald, Marshall Space Flight Center engineers, examine instrumentation connections of the model of the Space Shuttle vehicle.

SHUTTLE MODEL TESTED

The Marshall Space Flight Center is conducting static firings on a small scale (6.4 per cent) model of the Space Shuttle to gather acoustical data vital to design and development activities.

The series of 24 acoustic test firings using the 12-foot-tall model will continue through November, with seven additional tests slated later to study possible sound suppression methods.

The model's two solid engines produce a thrust of about 10,800 pounds each, while the three liquid engines produce a total thrust of about 5,000 pounds.

During each 20-second test firing, 60 acoustic measurements are taken by specialized microphones mounted inside the scale model vehicle and on the ground in the adjacent area.

Of direct concern to engineers are the acoustic environments which could induce severe structural response and subsequent fatigue or malfunction of systems basically sensitive to high sound-pressure levels.

LUNAR SAMPLE EXHIBITS

The following is a schedule of lunar sample exhibits from Oct. 15 to Nov. 15, 1974:

CALIFORNIA — San Diego County Rockbound Gemboree, San Diego, Oct. 26–27.

GEORGIA — Farmers Appreciation Day, Rochelle, Oct. 26.

GERMANY — Deutscher Edelsteintag (German Gemstone Day), Dusseldorf, Oct. 17–20.

ILLINOIS — Mid-State Coin Club, Clinton, Oct, 27.

KENTUCKY — Sciences in the 70's, Morehead State University, Morehead, Oct. 16.

MINNESOTA — FAA Open House, 512 Division Street, Farmington, Oct. 31–Nov. 7.

NORTH DAKOTA — Grand Forks AFB Coin Club, Grand Forks, Oct. 19–20.

OKLAHOMA — Tulsa Public School System Awareness Program, Tulsa, Oct. 28–Nov. 15.

OHIO — Moon Rock Display, Wauseon High School, Wauseon, Oct. 14–18.

SOUTH CAROLINA — South Carolina State Fair, Columbia, Oct. 18–26.

TEXAS — Houston Museum of Natural Science/History, End of Caroline at Hermann Park, Houston, Oct. 15–Nov. 15.

NEW NASA PUBLICATION

THIRD EARTH RESOURCES TECHNOLOGY SATELLITE-1 SYMPOSIUM, Volume 1: Technical Presentations (NASA SP-351), is now available from the Government Printing Office. It contains significant results from ERTS-1 in various disciplines that were presented at a NASA-sponsored Symposium in Washington last December and was prepared for publication at the Goddard Space Flight Center.

RADIO-TELEVISION (Released Nationally)

October

TELEVISION — A color film release the *Aeronautics and Space Report*, "Solar Energy," from MSFC featuring Dr. Harrison Schmitt.

RADIO — Four weekly *Space Stories* are to be released: "Truck Aerodynamics," (FRC/Saltzman); "HEAO," (MSFC/Speer); "Space Medical Benefits," (ARC/Dr. Williams); and "Mariner 10 Re-Encounter," (Dr. Robert Strom).

One *NASA Special Report*, "Apollo-Soyuz Status," (Chester Lee).

HEADQUARTERS PRESS RELEASES

74–245	Programs Through Satellite to Be Demonstrated
74–246	Apollo-Soyuz Crews to Observe, Photograph Earth Features
74–247	Apollo-Soyuz Crews to Produce Own "Solar Eclipse"
74–248	Mariner 10 Set for Second Look at Mercury
74–249	NASA Langley Center Features Week-long Technology Review
74–250	Jupiter Press Briefing Set for Sept. 10
74–251	WESTAR-B Launch Set for Oct. 8
74–252	Dr. John Naugle to Receive High Civil Service Award
74–253	NASA Facilities Track Hurricane Carmen, House Refugees
74–254	Satellites Play Major Role in Hurricane Warnings
74–255	Satellite Provides High Quality Ship Communications
74–256	Experimental Weather Satellite Pictures Offered
74–257	Mars Camera Tests Delight Scientists
74–258	Duward L. Crow Named to Interagency Affairs Post
74–259	NASA Journal Lists New Research Projects
74–260	NASA Developing "Autonomous" Robot
74–261	Launch Vehicle Being Groomed for ASTP Mission

WAIVER OF PATENT RIGHTS

(During the period of January through June, 1974, the Inventions and Contributions Board recommended that waiver of patent rights to inventions be granted to the NASA contractor organizations and individuals listed below. The Administrator of NASA subsequently reviewed the recommendations and granted the waivers. The grant of waiver gives the petitioner for patent waiver exclusive rights to commercialize an invention for the ultimate use by the general public while reserving to the government free use of the invention.)

Petitioner	*Title of Invention*
California Institute of Technology	Improved Solar Cell Grid Patterns
Do.	Space-Change-Limited Solid-State Triode
Do.	Gas Chromatograph
Do.	An Automated System for Identifying Traces of Organic Chemical Compounds in an Aqueous Solution
Do.	System for and Method of Extract Concentration and Direct Injection
Do.	Method of Apparatus for the Detection of Nitric Oxide
Do.	Advanced Priority Interrupt Module
Do.	Cross-Linked Mixed Chain Polymers
Massachusetts Institute of Technology	Electronic Power Source
Do.	First-Order Phase-Lock Loop
TRW, Incorporated	Cold Cathode Configuration and Means for Electrical Isolation of Pressure Sensing and Control Appendages
Do.	Boot Strap Optimal Signal Combiner for Coherent Noise Environment

2 - WAIVER OF PATENT RIGHTS

McDonnell Douglas Corporation	Contamination Separator
IBM Corporation	Pulse Transformer for Injection Laser
Manlabs, Inc.	Refractory Material of Improved Fracture Toughness
Kollsman Instrument Company	Beryllium Surface Treatment
University of Wisconsin	A 1-Dimentional Multimode and Multistate Oscillator
J.W. Microelectronics, Inc.	Complex Coordinator
Urs E. Hochuli	Cold Cathode for CO_2 Lasers
Perkin Elmer Corporation	Interferometer for Testing Telescope Optics
Sperry Rand Corporation	Hilographic Storage in Copper Doped Strontium Barium Niobate
Rockwell International Corporation	Suppressing the formation of Hard Bubbles

INVENTIONS AND CONTRIBUTIONS BOARD MONETARY AWARDS

(The Inventions and Contributions Board, at its meetings of April 30 and May 30, 1974, recommended that monetary awards be granted to the NASA employees and the NASA contractor employees identified on the following list for scientific and technical contributions to space and aeronautical activities. The recommendations were approved by the Administrator and the awards have been made.)

Inventor(s)	*Title of Invention or Contribution*
BOEING COMPANY	
David R. Clarke	Thermal Compression Bonding of Interconnectors to solderless Silicon Solar Cells
GODDARD SPACE FLIGHT CENTER	
Aaron Fisher Carroll H. Clatterbuck	Process for Making RF Shielded Cable Connection Assemblies
W.C. Webb P.A. Bracken R.A. Hoffman M.L. Stefurak James L. Michael M. Lavenstein	Telemetry Processor

INVENTIONS AND CONTRIBUTIONS BOARD MONETARY AWARDS—Con't.

GTE SYLVANIA

Theodore Arken Lawrence E. Mallery	Balloon Borne Differential Temperature Sensor and Transmission System
Theodore Arken	Linearization Circuit for Radio Frequency Transmission System
Theodore Arken Lawrence E. Mallery	Detachment Apparatus for Balloon Borne Equipment

HUGHES AIRCRAFT COMPANY

Norman Bilow Richard I. Ankawie	Thiophenyl Ether Disiloxanes and Trisiloxanes Useful as Lubricant Fluids

JET PROPULSION LABORATORY

Shalhav Zohar	Counting Digital Filters
Jack K. Holmes Christopher Carl Carl R. Tagnelia	Digital Second-Order Phase-Locked Loop
Michael F. Hanns Harry K. Detweiler	High Isolation R.F. Signal Selection Switches
Wayne M. Phillips	Cermet Composition and Method of Preparation
Wayne M. Phillips Jack P. Mondt	Nuclear Thermionic Converter
Joseph Maserjian	Deep Trap, Laser Activated Image Converting System
Ronald A. Marzek William S. Read	Tool for Use in Lifting Pin-Supported Objects
Edgar F. Koch	Combined Pressure Regulator and Shutoff Valve
Daniel D. Elleman Melvin M. Saffren Taylor C. Wang	Material Suspension Within an Acoustically Excited Resonant Chamber

LANGLEY RESEARCH CENTER

Raymond L. Clark	Apparatus and Method of Coating Small Particles
Chris Gross	Infrared Detectors
Wayne S. Slemp	Particulate and Solar Radiation Stable Coating for Spacecraft
Lawrence J. Bement	Totally Confined Explosive Welding
Willard W. Anderson Nelson Groom	Annular Momentum Control Device
Stacey M. Mills Dr. Jerold R. Wilkens	Automatic Inoculating Apparatus
William F. Crosswell Oran W. Nicks	Dielectric Loaded Aperture Antenna
Richard E. Kuhn Joseph L. Johnson, Jr. Willard S. Blanchard, Jr. Tom F. Bonner, Jr.	Quiet Jet Transportation

LEWIS RESEARCH CENTER

Edward A. Maslowski	Insulation Foil and Method for Making
Albert J. Juhasz Richard W. Niedzwiecki	Controlled Separation Combustor

LOCKHEED ELECTRONICS COMPANY

Robert W. O'Neill	Peak Holding Circuit for Extremely Narrow Pulses
Reed S. Lindsey, Jr.	Pulse Stretcher for Narrow Pulses
Reed S. Lindsey, Jr.	Random Pulse Generator

INVENTIONS AND CONTRIBUTIONS BOARD MONETARY AWARDS—Con't.

MARSHALL SPACE FLIGHT CENTER

Werner K. Dahm, Robert M. Huffaker	Clear Air Turbulence Detector
William J. Robinson, Jr.	Microwave Power Transmission
Edward L. Shriver	Self-Energized Plasma Compressor
William J. Abernathy	Sine Grinding heel
George E. Thornton, Davis T. Newby	Hole Cutter

MEGA ANALYTICAL RESEARCH SERVICES

Richard E. Dame	Piezoelectric Actuator

NATIONAL ACADEMY OF SCIENCE

Eduard B. Ingenbergs	Self-Energized Plasma Compressor

NATIONAL SCIENCE FOUNDATION

Juan S. Chatterjee	Dielectric Loaded Apparatus Antenna

NAVAL UNDERWATER SYSTEMS CENTER

Ian A. Richter	Dual Digital Video Switcher

RALPH M. PARSONS

Edward Hryniewiecki	Vehicle for Use in Planetary Exploration

RAYTHEON COMPANY

Donald J. Delgrego, Irving Goldstein, Albert V. Jelalian, Wayne Keene, Perry A. Miles, Charles M. Sonnenschein	Clean Air Turbulence

UNIVERSITY OF CALIFORNIA

Dr. Barry Sacks	Magnetically Activated Turnable Gun Oscillator

UNIVERSITY OF VIRGINIA

Robert J. Mattauch	Infrared Detectors

WOLF R&D

L. Erlichman, C. E. Mills, B.R. Mancinelli	Telemetry Processor

PATENTS FOR INVENTIONS RESULTING FROM NASA RESEARCH

"The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.

Inventor(s) and Employer	*Title and NASA Docket*	*Patent No.*	*Installation*
Bruce Flagge, NASA/LaRC	Measuring Probe Position Recorder (LAR-10,806-1)	3,832,781	LaRC
William Elkins, Eugene Connell and Robert E. Alesna, Garrett Corp, Los Angeles, CA	Flexible Joint for Pressurizable Garment (MSC-110/72)		

PATENTS AND INVENTIONS RESULTING FROM NASA RESEARCH—Con't.

Michaeal G. Goodyer, National Academy of Science, Washington, DC	Stagnation Pressure Probe (LAR–11,139–1)	3,832,903	LaRC
Ronald A. Marzek and William S. Read, Caltech, Pasadena, CA	Tool for Use in Lifting Pin-Supporting Objects (NPO–13,157–1)	3,832,764	NaPO
Lawrence E. Dickens, Westinghouse Electric Corp., Pittsburgh, PA	Millimeter Wave Pumped Parametric Amplifier (GSC–11,617–1)	3,833,847	GSFC
Euple I. Palmer, NASA/MSFC	Heart Simulator (MFS–21,609–1)	3,833,865	MSFC
William L. Ray, NASA/MSFC	Remote Fire Stack Igniter (MFS–21,609–1)	3,833,336	MSFC
William N. Peters, Perkin-Elmer Corp., Norwalk, CN	Interferometer for Testing Telescope Optics (GSC–114/73)	3,836,256	GSFC
Paul R. Yeager and Gianni Gaetano, NASA/LaRC, and David B. Hughes, Bell & Howell, Pasadena, CA	Fast Scan Control for Deflection Type Mass Spectrometers (LAR–11,428–1)	3,835,318	LaRC
Rodney S. Goering, NASA/LaRC	Open Tube Guideway for High Speed Air-Cushioned Vehicles (LAR–10,256–1)	3,837,285	LaRC
Albert Topits, Jr., Caltech/JPL, Pasadena, CA	Apparatus for Forming Drive Belts (NPO–13,205–1)	3,833,322	NaPO
Glen A. Mitchell and Bobby W. Sanders, NASA/LeRC	Airflow Control System for Supersonic Inlets (LEW–11,188–1)	3,799,375	LeRC

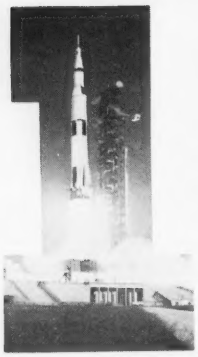
1974 LAUNCH SCHEDULE

Name	*Launch Date*	*Vehicle*	*Range*	*Mission/Remarks*	
Skynet II–A (UK)	Jan. 18	Delta	ETR	Reimbursable launch. United Kingdom's communications satellite.	Unsuccessful
Centaur Proof Flight	Feb. 11	Tital III–E Centaur	ETR	Test flight of booster planned for Viking Mars launch in 1975.	Unsuccessful Engine failure
San Marco (SM–C2)	Feb. 18	Scout	SM	United States/Italy cooperative mission to conduct air density measurements.	Launched
UK X–4	Mar. 8	Scout	WTR	Reimbursable launch. United Kingdom technology satellite with experiments related to spacecraft power systems, altitude control and stabilization.	Successful
WESTAR–A	April 13	Delta	ETR	Western Union communications satellite. Reimbursable launch.	Successful
SMS–I	May 17	Delta	ETR	First prototype/developmental mission for geostationary meteorological operational satellite system; day and night continuous imaging of cloud cover; sophisticated remote-platform data-collection-and weather data relay.	Launched
ATS–6	May 30	Tital III–C	ETR	Developmental and demonstrative communications mission using technology applicable to terrestrial and space needs; utilizes 9.15-meter (30-foot) deployable parabolic antenna and communications system with frequencies in several bands; will support public communications experiments in the U.S. and India.	Successful
Hawkeye (formerly Injun-F)	June 3	Scout	WTR	To study the topology of the magnetic field at large radial distance over the Earth's dgear caps and the interaction of the solar winds with the geomagnetic field.	Launched
AEROS-B (German)	July 16	Scout	WTR	Spin-stabilized, Earth-orbiting satellite designed for upper atmosphere measurements.	Successful

1974 LAUNCH SCHEDULE—Con't.

Netherlands Sat.–A (ANS–A)	August 27	Scout	WTR	Designed to obtain data from celestial X-ray and ultraviolet sources.	Launched
WESTAR-B	Oct. 10	Delta	ETR	Western Union communications satellite. Reimbursable launch.	Launched
UK–5	Oct. 15			To investigate galactic and extra galactic X-ray sources.	Launched
ITOS-G	Oct. 29	Delta	WTR	Polar-orbiting operational meteorological satellite funded by NOAA; day and night cloud cover and temperature sounding. Launch includes two piggyback payloads, Intasat and Oscar.	
Nimbus F	October	Delta	WTR	Meteorological research and development mission to test instruments for expanding atmospheric remote sensing to cloud regions, extend observations to new spectral regions, extend sounding capabilities to higher altitudes, demonstrate feasibility for improvements to operational systems, and support GATE.	
Skynet II-B (UK)	November	Delta	ETR	Reimbursable launch. United Kingdom communications satellite.	
GEOS-C	December	Delta	WTR	Geodynamic Experimental Ocean Satellite to demonstrate feasibility of satellite-altimeter techniques for measuring the topography of the ocean surface; can be significant contribution to understanding of ocean dynamics.	
Helios-A	December	TitaN III	ETR	To investigate the properties of and processes in interplanetary space in the direction of and close to the Sun by developing, launching and operating automated spacecraft.	
Comsat-A	4th Qtr.	Delta	ETR	First of two maritime communications satellites to be situated over Atlantic and Pacific Oceans.	
Symphonie-A (French/German)	4th Qtr.	Delta	ETR	Experimental communications satellite. Reimbursable.	
Intelsat IV F–8	(Under Study)	A-Centaur	ETR	One of a series of communications satellites to form part of a global communication commercial satellite system. Launch for COMSAT.	
WESTAR-C	(Under Study)	Delta	ETR	Western Union communications satellite. Reimbursable launch.	
Intelsat IV F–1	(Under Study)			One of a series of communications satellites to form part of a global communications commercial satellite system. Launch for COMSAT.	
Intelsat IV F–6	(Under Study)			One of a series of communications satellites to form part of a global communications commercial satellite system. Launch for COMSAT.	
SMS-B	(Under Study)	Delta	ETR	Second prototype/developmental mission for geostationary meteorological operational satellite system; same as SMS-I.	
GOES-A (SMS–C)	(Under Study)	Delta	ETR	First Geostationary Operational Environmental Satellite, follow-on to SMS missions, funded by NOAA.	

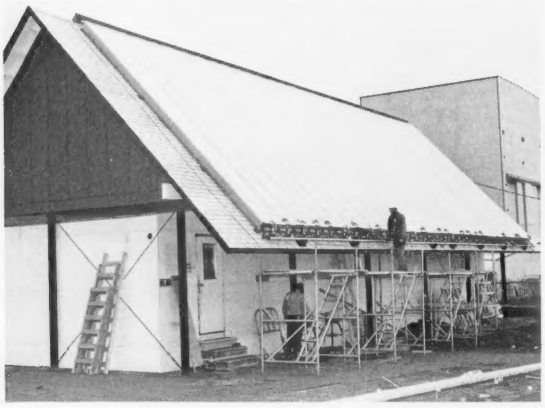
ARE YOU GETTING YOUR

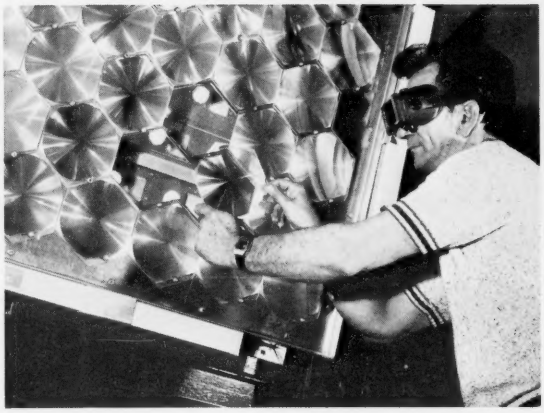


WORTH FROM SPACE?

FOR A PENNY OF YOUR TAX DOLLAR, YOU ARE GETTING ...

SOLAR ENERGY RESEARCH





The technology used in the Skylab space laboratory to keep it functioning and habitable by astronauts is now being applied in experiments to heat and cool private homes and office buildings.

The first phase of testing was started months ago at NASA's Marshall Space Flight Center, Huntsville, AL, where the simulated solar house pictured on the left was erected for experimentation. Meanwhile, the Lewis Research Center, Cleveland, is testing experimental solar collectors designed to capture the Sun's thermal energy for heating and cooling a one-story office building under construction at the Langley Research Center, Hampton, VA. The Lewis solar simulator shown at right is used to test new designs of these solar thermal energy collectors.

Development testing at the Marshall Center is in its early stages. The solar house is equipped with 1,300 square feet of collectors and a 4,000-gallon hot water energy storage tank.

For heating the solar house, the solar heated water is diverted through coils in a duct. A fan blowing across the hot coils forces heated air through ducting to heat the house.

For air conditioning, the solar heated water is diverted to another set of coils, providing the heat to separate water from lithium bromide. The separated fluids are rapidly remixed to produce cooling. This repetitive process is known as absorption cycle air conditioning.

Dr. Harrison H. Schmitt, NASA Assistant Administrator for Energy Programs, is optimistic that within the next three to five years transfer of solar heating and cooling technology into the commercial sector can be achieved. In time, the Sun could provide as much as 20 to 30 per cent of the U.S. energy needs, he believes.

"I am very confident about the use of solar energy," Dr. Schmitt says. "I believe it is one of the essentially untapped, inexhaustible sources of clean energy that the nation and, in fact, on which the world can depend."

NASA

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"FOR THE BENEFIT OF ALL MANKIND."

AMERICAN REVOLUTION BICENTENNIAL 1776-1976